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ABSTRACT

This paper makes basic assumptions regarding the development of an intranet architecture that will actively promote the cognitive apprenticeship of a new community of learners. The authors consider the intranet as a dynamic and virtual environment in which individuals may communicate, share resources, and reciprocally generate and organize learning strategies leading to knowledge and self efficacy. First, the paper describes a proposed architecture supported by an exemplar called SAGE-ISO that includes the following cognitive tools: browsing for information regarding ISO 9000 standards, as well as a company's quality system; advising the user on deploying the quality procedures; and training through a set of learning resources. Secondly, it highlights the following cognitive variables that can act as building blocks towards an efficient intranet foundation: learning should be an active and not a passive experience; learning can be facilitated by situating the learner within an authentic setting; and learners should take charge of their own learning. The final section provides a brief overview of development issues regarding Internet/intranet technologies and tools and presents a proposed architecture. Two figures illustrate the architecture of the intranet training environment and the proposed internal architecture, and a table presents examples of tools and technologies. Contains 13 references. (AEF)

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# The Intranet as a Cognitive Architecture for Training and Education: Basic Assumptions and Development Issues

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**Abstract**: In this article, we make basic assumptions regarding the development of an intranet architecture that will actively promote the cognitive apprenticeship of a new community of learners. We consider the intranet as a dynamic and virtual environment in which individuals may communicate, share resources, and reciprocally generate and organize learning strategies leading to knowledge and self efficacy. First, we describe our proposed architecture supported by an exemplar called SAGE-ISO. Secondly, we highlight several cognitive variables that can act as building blocks towards an efficient intranet foundation. We close our discussion with a brief overview of development issues regarding Internet/intranet technologies and tools.

## Training/Education and Internet Technologies/Tools

Traditional computer-based instruction (CBI) has the capacity of being dynamically transformed by **I**nternet/**I**ntranet **T**echnologies and **T**ools (ITT). Independent of computer hardware, this platform can support just-in-time media-rich content, as fresh as the moment and modified at will. It also offers a flexible structure allowing self-directed, self-paced instruction on any topic, capable of being supported by adaptive remedial and assessment strategies.

ITT is also an ideal vehicle for effective courseware delivery to individuals anywhere in the world at any time. Advances in computer network technology and improvements in bandwidth are presently introducing unlimited point-to-point as well as multi-point multimedia on-demand. Web browsers supporting 3-D virtual reality, animation, interactive transactions and conferencing are also presenting unparalleled training and education opportunities. Web-based performance systems can also actively support today's demanding workforce by integrating information systems, job aids as well as anchored instruction into unified systems available on demand.

The current focus of Web-based development is concerned with learning how to use available Internet technologies and tools as well as organize content into well-crafted teaching systems. The Web is a vehicle for the distribution of resources as well as a medium of expression-representation with its own specificity. Training designers are presently struggling with issues of user interface design and programming directed at high levels of interaction. Unfortunately, there are very few examples of good Web-based design available on the public Internet. As instructional designers and courseware developers learn to write and produce Web based resources, and as training vendors come to realize the overwhelming advantages of this delivery method, we can expect an explosion in training offerings available over the public Internet and corporate intranets.

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The paper is organized as follows : Section two describes our proposed architecture supported by an exemplar called SAGE-ISO. Section three addresses several cognitive variables that can act as building blocks towards an efficient intranet foundation. Section four presents a brief overview of development issues regarding Internet/intranet technologies and tools.

## The Intranet Environment Architecture

### Present Accomplishments

Viewed from the end-user's perspective, [Fig.1] illustrates an architecture capable of supporting training and educational Internet/intranet transactions.

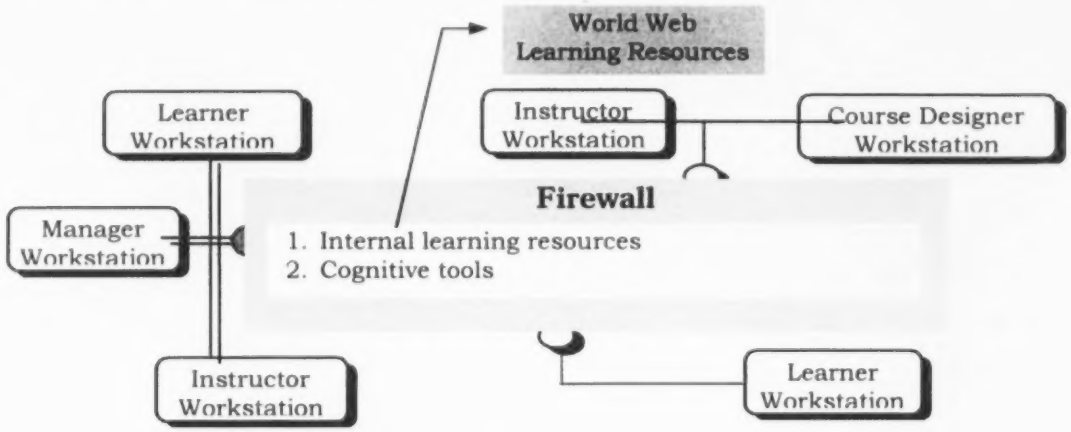


**Figure 1.** The Architecture of the Intranet Training Environment

SAGE-ISO is an exemplar that we have developed. It includes the following cognitive tools :

1. Browsing for information regarding ISO 9000 standards as well as a company's quality system.

2. Advising the user on deploying the quality procedures. Information supplied by the advisor tool concerns the main steps to be accomplished and the documents to be used. This tools aims also at reducing or avoiding errors due to an incorrect use of procedures.

3. Training through a set of learning resources. Each learning unit enables the user to attain a coherent and generally unique instructional goal.

The term learning resource has often been used with various meanings. Specifically, we make a distinction between two kinds of learning resource units:

1. Units promoting understanding or dispensing further information. Examples of these units include HTML documents, videos and simulations. The learner exploits these resources to achieve a greater understanding of the domain knowledge.

2. Units describing problem-based learning activities, cases studies and demonstrations. These units enable the learner to attain a coherent and generally unique instructional objective among those specified in the curriculum. Specifically, they refer to course objectives and their links with the appropriate learning resources [McCalla 92, Halff 88].

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## Future Considerations

Our next step is to design and develop cognitive tools that will actively support the Intranet learning process. Our challenge is to discover what that means in context. Computer-based instruction is traditionally rooted in well-defined course goals and objectives. They in turn are clearly stated in succinct terms associated with behavioral outcomes that are themselves directly related to corresponding sequences of instructional events. The end result is that hopefully, the user will experience a meaningful and satisfying learning outcome. Cognitive Psychology is concerned mostly with problem solving and the understanding of complex cognitive skills. In terms of learning, this is in direct contrast to memorizing large block of data or simply accomplishing procedural tasks. Learning is viewed as a constructive process where changes occur to the internal representation of knowledge [Wildman 81] Instead of learning responses to an event, the cognitive experience emphasizes learning the information [Shuel 87]. We advance the premise that the intranet as a dynamic and virtual environment in which individuals communicate, share resources, and have the potential to reciprocally generate and organize learning strategies is in need of a new, non traditional model for learning. Our understanding is based on a fundamental and yet uneasy compromise between traditional courseware delivery and user acceptation and a constructivist paradigm which is concerned with how we construct knowledge from our experiences, mental structures and beliefs that are used to interpret objects and events. The next section, examines our efforts in establishing a coherent set of tools for this new model.

# Cognitive Foundations

Our basic assumptions regarding the implementation of cognitive technology within this setting is that:

**(a) learning should be an active and not a passive experience.** Inert knowledge [Whitehead 29] is the process in which students acquire facts that they cannot access and use appropriately. Passive learning is the contraposition of intentional self-directed learning. [Brown 77] characterizes these two conditions as diseases of schooling and unfortunately, they are still in evidence as ongoing learning strategies. Memorizing large amounts of information and resources currently available in SAGE-ISO, is not what learning is all about. Learning theory predicts and studies have demonstrated that immediate and frequent feedback, cooperative learning and well structured exposition information and data can improve the learning process [Briggs 95]. Our challenge is therefore to create an intranet setting that will be a dynamic learning environment that will encourage reflective practice among students and teachers [Brown 1992]. Brown characterizes classrooms as work sites that are inhabited by students who perform assigned tasks under the management of teachers into a community of learners where the same students will be given significant opportunity to take charge of their own learning.

**(b) Learning can be facilitated by situating the learner within an authentic setting** . [Brown 89] has speculated that activity and situations are integral to cognition and learning. Our intranet environment describes a cognitive technology that will empower both the student as an individual and as a working contributor with other participants in search of virtual learning outcomes. SAGE-ISO is an example in which, Metacognitive strategies for learning and remembering are encouraged within the world of ISO 9001 Standards. Metacognitive skills are the strategies one uses to learn and to solve problems. SAGE ISO accomplishes this by (1) presenting the student with contextualized resources and information, (2) extending those resources and information leading to an acquisition of knowledge, (3) communicating this augmented knowledge and understanding with other participants within the course parameters.

**(c) Learners should take charge of their own learning** . [Rumelhart 80] reports a cognitive theory of learning that states that people successfully solve problems by developing mental models of the problem domain and applying their models at hand. [Shuel 87] asserts that learning is viewed as process of building, testing and refining these models until they are reliable in new problem solving situations. [Bandura 77] social cognitive

theory of human learning and functioning has also proposed the concept of reciprocal dynamic interactions. Our proposed intranet setting invites the individual to continually interact with a virtual environment that offers different ways of representing and modifying information and resources into knowledge.

## Development and Technological Issues

[Fig.2] illustrates the implementation of our proposed architecture based on current commercial tools and technologies and the conventional Internet infrastructure.

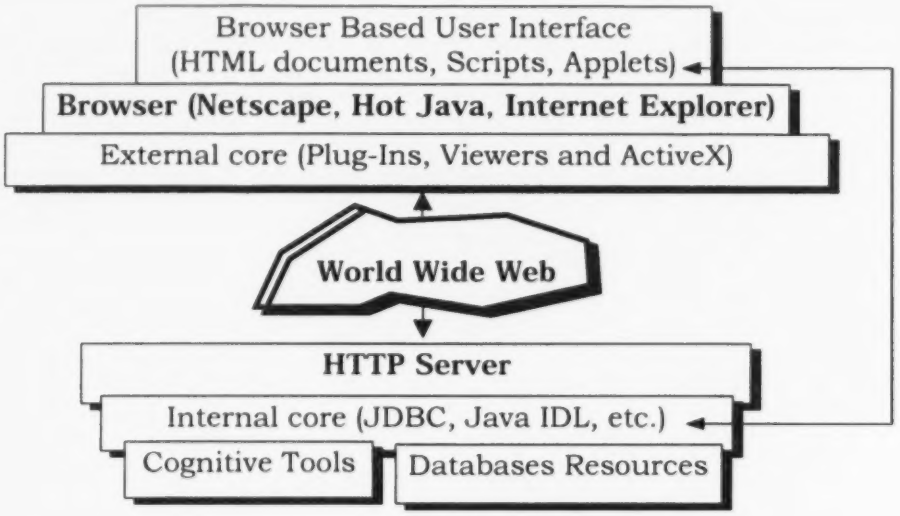


**Figure 2.** Proposed Internal Architecture

This implementation includes the following components:

1. a browser-based user interface consisting of several applets. As an example, SAGE-ISO exploits the *View Engine* applet which permits information and resources to be viewed from multiple perspectives. This functionality is extremely useful in encouraging the end-user to take charge of their own learning by personalizing their understanding of the content.

2. The external core is a set of Plug-ins, Viewers and ActiveX that extend the capabilities of the browser. This technology gives the end-user the possibility of manipulating different types of resources with the same method. As an example, in SAGE-ISO clicking on a hyper link in an HTML resource, can lead the end-user to discover several other resources such as a slide show within Power Point, a multimedia tutorial or a selected assessment strategy.

3. A multi layered, object-oriented repository which stores all information and resources.

4. The internal core is a set of drivers that bridge the resources database and remote objects with the HTTP server and the user interface.

[Tab.1] summarizes the major components with their appropriate tools and technologies.

| COMPONENTS | TOOLS AND TECHNOLOGIES |
|---|---|
| User Browser Interface | 1) Applets<br>2) HTML<br>3) Client Script generally written in JavaScript |
| Web Browser | 4) Internet Explorer<br>5) Netscape |
| External Core | 6) Plug-ins<br>7) Viewers<br>8) ActiveX |
| Web Server | 9) Internet Information Server<br>10) Netscape Enterprise Server |
| Internal Core | 11) CGI Scripts mostly written in Perl. However it possible to use an another language such as C, C++ or Java<br>12) ISAPI (Internet Server Application Programming Interface)<br>13) JDBC such as DbAnyWhere |

**Table 1.** Examples of Tools and Technologies

There are however, several limitations associated with the current technology and tools. They are viewed as serious obstacles to an effective and efficient intranet training and education environment. Examples of these limitations are (see also [Seffah 97] for further information):

- Applets have many restrictions and need much time for downloading.
- Servers need to be concerned re. trivial user interactions.
- Logically independent parts cannot run independently to serve multiple clients.
- The browser's BACK and FORWARD button mechanism is in direct conflict with a cognitive technology that encourages self-directed learning.
- Information and resources that are available outside the system cannot easily be cognitively integrated within the intranet training and education environment.

## Conclusion

In this paper, we have presented the foundation of an intranet environment that actively promotes a Metacognitive technology approach to complex training and educational problems in need of interconnected solutions.

Some of the foundations issues discussed in this paper have been implemented and repeatedly tested through our exemplar SAGE-ISO. Many companies have also validated our cognitive architecture. Our preliminary conclusion regarding this new architecture is encouraging us to continue our research and development towards a cognitive perspective.

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